Data Quality Objectives

Data Quality Objectives (DQOs) are qualitative and quantitative statements derived from the output of the first six steps of the DQO process shown in Figure [*to be added*]. The DQO process is an iterative, strategic planning approach designed to generate environmental data that are the type, quality, and quantity appropriate for utilization in a particular project's decision making process.

This Section begins with a "project-level" statement of the DQOs intended to describe the framework for addressing environmental contamination at the Lower Passaic River Restoration Project Study Area, focused on the probable decision needs of the project management team and the overall RI/FS process. This is followed by 6 tables that present technical DQOs for the proposed RI/FS data gathering effort.

1.0 State the Problem

Sections 1.0 through 3.0 of the Work Plan (WP) summarize the history of the Study Area and evaluations of available data regarding sediment and water column contamination. The Conceptual Site Model (CSM), which identifies the sources and mechanisms of potential contaminant release within the Study Area and the possible pathways whereby human and ecological receptors may be exposed to sediment contaminants, is provided in the Pathways Analysis Report (PAR, Battelle 2004) and in Section 4.0 of the WP.

The current effort to be implemented for the Study Area and addressed in these planning documents includes both Comprehensive Environmental Response, Compensation and Liability Act (CERCLA) and Water Resources Development Act (WRDA) objectives and is to obtain data to:

- prepare the CERCLA RI/FS report for the Passaic River Study Area.
- develop human health and ecological risk assessments for the Passaic River Study Area.
- support a comprehensive, watershed-based plan to restore the functional and structural integrity of the Lower Passaic River ecosystem and to support broader, watershed-wide restoration efforts under WRDA.

At this time, the WRDA restoration efforts is primarily focused on the identification and screening of "candidate restoration sites." Suitable candidate restoration sites will be located in the Passaic River Estuary (*i.e.*, along the Lower Passaic River or along its tributaries), will not be contaminated above ecological risk levels (to be identified), and will be appropriate for wetland rehabilitation efforts.

The project team assembled to implement the RI/FS investigation effort is identified in the organizational chart provided as Figure [*to be added*]. The responsibilities of the project team members are described in the Quality Control Plan. A project schedule is provided in Figure [*to be added*]. Field efforts to obtain the necessary data for the RI/FS are expected to be conducted from the fall of 2004 through fall of 2008.

2.0 Identify the Decision

The principal study questions to be answered through the RI/FS process are the following:

- What are the contaminants of potential concern (COPC) and potential ecological concern (COPEC)?
- What are the quantitative human and ecological health risks posed by the contamination?
- Does the risk assessment warrant remedial action?
- What is the recommended remedial alternative, based on the CERCLA evaluation criteria?

The remedial alternatives to be considered for this RI/FS will include: a "no action" alternative; monitored natural recovery (MNR); sediment removal alternatives (*i.e.*, dredging), one or more of which may include ex-situ treatment; in-situ treatment; and capping.

In addition to the CERCLA study questions, the WRDA efforts require answers to the following principal questions:

- Do proposed candidate restoration sites meet the "screening criteria" for ecosystem rehabilitation described in the Field Sampling Plan Volume 3 (refer also to Table 6)?
- What is the appropriate restoration design for suitable candidate sites?
- [*Other WRDA study questions are to be developed*.]

The study questions are further modified by the "Fundamental Questions" listed below, which were developed by the project management team. Questions 1 through 3 were provided by USEPA in May 2004; questions 4 and 5 were proposed as the result of a brainstorming session held the morning of October 20, 2004 and attended by key project staff from Malcolm Pirnie and Battelle.

1. If we take no action on the River, when will the COPCs recover to acceptable concentrations?[1]

2. Can any action we take on the River significantly shorten the time required to achieve acceptable or interim risk-based concentrations for human receptors and ecological receptors?

3. Are there contaminated sediments now buried that are likely to become "reactivated" following a major flood, possibly resulting in an increase in contaminants within the fish/crab populations?

4. Can any action we take on the River or adjacent areas significantly improve the functionality of ecosystems within the Lower Passaic River watershed?[2]

5. If the risk assessment for Newark Bay demonstrates unacceptable risks due to export of contaminants from the Passaic River, will the plan proposed to achieve acceptable risks for Passaic River receptors significantly shorten the time required to achieve acceptable or interim risk-based concentrations for human and ecological receptors in Newark Bay, or will additional actions be required on the Passaic River?[3]

The Fundamental Questions address major issues associated with the RI/FS study questions. For example, questions 1 and 3 are pertinent to the evaluation of a MNR alternative, in that they address the duration for MNR to reach acceptable contaminant concentrations and sediment stability issues. In addition, question 4 addresses WRDA issues that are to be considered along with the CERCLA RI/FS effort.

3.0 Identify the Inputs to the Decision

The following major inputs are required to answer the RI/FS and WRDA study questions identified in Step 2 of the DQO Process:

1. A hydrodynamic and hydrological model of the Study Area to facilitate evaluation of sediment and water column contaminant fate and transport
2. Physical, hydraulic, hydrologic, and hydrodynamic data to calibrate and validate the model of the Study Area
3. Sediment and water column analytical data to establish the nature and extent of contamination
4. Exposure assessment data to complete the human and ecological health risk assessments
5. Physical and chemical data necessary for evaluation of remedial alternative performance in the Study Area (*e.g.*, debris survey and sediment geotechnical data required for dredging feasibility evaluation)
6. Remedial alternative performance data (*e.g.*, unit costs, short-term effectiveness, long-term effectiveness, implementability, *etc.*) to facilitate the comparative evaluation of alternatives for the FS

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[1] with "acceptable" defined by risk assessment, based on fish/crab ingestion for humans and ecological receptors, and ARARs.
[2] with "significantly" requiring policy input
[3] note that this question is a shared one with the RI/FS for the Newark Bay OU since the actual benefits of such reduction will need to be jointly determined; DQO's will lay out the appropriate limits of investigation for the LPRRP

7. Characterization of physical and chemical properties of environmental media at candidate restoration sites to evaluate the feasibility of WRDA restoration efforts
8. Ancillary elements to facilitate data acquisition, presentation and analysis, such as site mapping, GIS, and PreMIS project database

4.0 Define the Boundaries of the Study

The physical boundaries of the RI/FS include the 17-mile reach of the Lower Passaic River Restoration Project Study Area, from Newark Bay to the Dundee Dam, including an assessment of the boundary conditions at its tributaries (*e.g.*, First River, Second River, Saddle River, *etc.*). The temporal boundaries of the RI/FS extend to include all historic data that meet the Data Quality Scheme of the Historical Surface Sediment Data Evaluation (Malcolm Pirnie, 2004), as summarized in Section 3.0 of the WP, and the projected duration of the RI/FS field investigation effort (2004 through 2008).

The physical boundaries of the WRDA restoration effort encompass the Passaic River Estuary. For example, proposed candidate restoration sites may be located along tributaries to the Lower Passaic River, distant and up-estuary from the boundary condition sampling at the juncture of the tributary and the Lower Passaic River that generally marks the limit of the CERCLA RI/FS investigation.

5.0 Develop a Decision Rule

The following primary decision rules will be used to answer the principal study questions of the CERCLA RI/FS and WRDA efforts:

1. If the human carcinogenic risk exceeds 1×10^{-6} and/or the non-carcinogenic hazard quotient exceeds 1, the portion(s) of the Study Area associated with the unacceptable human health risks will be considered for remedial action.
2. If the ecological risk hazard quotient exceeds 1, the portion(s) of the Study Area associated with the unacceptable ecological health risks will be considered for remedial action.
3. Applicable remedial alternatives (including the no action alternative) will be comparatively evaluated according to the CERCLA evaluation criteria. The remedial alternative with the most favorable combined weighting following the evaluation will be recommended.
4. WRDA Candidate Restoration Sites with environmental contaminants detected below the selected criteria (to be determined) for applicable media will be recommended for ecosystem rehabilitation.

6.0 Specify Limits on Decision Errors

Since the field sampling design is not yet finalized, decision errors can only be discussed qualitatively at this time. Tolerable limits on decision errors will be added in subsequent submittals. The general types of decision errors that may be encountered on this project are listed below along with examples of mitigative measures.

1. <u>Laboratory Analytical Errors</u>. It is possible that laboratory analytical data will include false negative results (low bias) or false positive results (high bias). These types of errors could lead to an underestimate of contaminated areas/inadequate remedial action or an overestimate of contaminated areas/unnecessary remedial action, respectively. Laboratory analytical errors will be controlled by establishing appropriate controls for data quality (*e.g.*, initial and continuing calibration verification standards, internal standard and surrogate recoveries, laboratory control samples, *etc.* as appropriate for each analysis) and validating the resultant data to evaluate potential bias. The project team will consider the validation results during remedial decision making.
2. <u>Laboratory Analytical Sensitivity</u>. Improper specification of laboratory method detection limits (MDLs) and reporting limits (RLs) could reduce the usability of the collected data for RI/FS decision making. Required MDLs and RLs will be carefully selected for the dual objectives of human health/ecological risk assessment sampling and examination of the spatial distribution of sediment contamination. Consideration of risk assessment "effects levels" and likely remediation goals, respectively, will be the basis of contractual MDL and RL requirements.
3. <u>Field Screening Errors</u>. A number of screening analyses (field bioassay, field x-ray fluorescence or “XRF”, float surveys, and underway sediment sampling) are under consideration to locate source areas/"hot spots." Due to uncertainty and potential bias in the field analytical techniques and based on

the selected spatial scale of the survey techniques (*e.g.*, spacing of survey lines for underway sediment sampling and frequency of water column sampling during float surveys), some contaminant source areas may go undetected. Potential bias in bioassay and XRF field screening will be controlled by confirmatory lab analyses to correlate field screening results with laboratory analytical data. In addition, survey efforts will be implemented in an iterative manner (*i.e.*, subsequent float surveys will adjust sampling locations and frequency based on the review of the results of the initial survey, *etc.*).

4. Sediment Core Sampling Density. The proposed size of the sediment core sample population must be adequate to characterize the Study Area. During design of the Low Resolution Coring Program, USEPA Decision Error Feasibility Trials (DEFT) software will be used to evaluate the necessary sample population to provide acceptable percentages of Type I (false positive) and Type II (false negative) errors, considering the statistical distribution and variance of the historic data set. This evaluation will be updated after the Low Resolution Coring Program implementation to establish a basis for potentially required data gap coring efforts.
5. Modeling Errors. Potential errors in the hydrodynamic and sediment fate and transport modeling will impact remedial decision making. For example, errors in the rates selected for sediment deposition and/or scour could lead to inappropriate conclusions regarding the potential burial of contaminated sediments, possibly causing inadequate remediation. Modeling errors will be controlled by evaluating direct measurements of parameters whenever possible (such as evaluation of depositional chronology from High Resolution Cores) and by testing the model's skill at prediction of known parameters. The nature of future development in the Study Area may also impact the effectiveness of the model's predictions (70-year prediction to be examined). To control this source of error, data gathered via WRDA real estate and socioeconomic investigations will be assessed to characterize likely future development in and around the Study Area.
6. Geophysical Survey Error. The geophysical data from the side scan sonar (SSS) and sub-bottom prove-out will be evaluated by an experienced marine geophysicist to assess the utility of the obtained data. If the geophysical methods are not found to be applicable for the Lower Passaic River, alternate methods will be evaluated to address the associated study questions (*e.g.*, magnetometer and/or underwater camera surveys may be implemented to identify debris targets that could impact dredging feasibility) and/or the study questions will be fulfilled to the greatest extent possible by other programmed investigations (*i.e.*, if sub-bottom surveys are not found to be useful, the depth extent of contaminated sediments and their physical description will be assessed primarily through examination and chemical analysis of core samples).
7. Errors in Mass Balance/Evaluation of External Loads. Potential errors in estimates of external contaminant loads to the system will result in errors/uncertainty in the Lower Passaic River contaminant mass balance and remedial decision making. For example, CSO sampling during storm events may not adequately represent unknown and intermittent industrial discharges. The sampling design will be optimized, where possible, to obtain the most representative samples, and in this example, it may be possible to sample sludge within the combined sewer system to attempt to further characterize the spectrum of contaminants/discharges present in the system. Errors will also be controlled by iterative sampling events and by considering each line of evidence (results of CSO, float survey, water column, and sediment sampling) that address the potential impacts of point source discharges within the Study Area.
8. Errors/Uncertainty in Risk Assessment. If risks associated with site-related exposures are overestimated (*i.e.*, false positive), a potential consequence is unnecessary remedial work that could itself be biologically detrimental. If risks are underestimated (*i.e.*, false negative), a possible consequence is to fail to conclude that remedial action is required, resulting in continuing potential for adverse effects to human health. To control these possible errors, exposure parameters will be carefully selected to represent realistically conservative scenarios.
9. Errors/Uncertainty in Remedial Alternative Performance Data. The comparison of remedial alternatives for the FS effort requires the assessment and weighting of remedial alternative performance data (*e.g.*, ex-situ treatment cost per ton, percent reduction in contaminated volume). This data is primarily obtained from literature, seminar presentations, and interviews with USEPA and other agency project management staff. Errors in reported performance data will skew the comparative evaluation of alternatives and could lead to a less than optimal recommended alternative. Decision errors will be controlled by conducting a literature survey to identify and compare multiple sources of

performance data, where possible, and by considering the findings of Passaic River pilot study efforts conducted by NJDOT-OMR.

7.0 Optimize the Design for Obtaining Data

The RI/FS field investigation design was optimized by conducting a "technical DQO" development effort for each of the proposed field investigation and data gathering efforts, as presented in Tables 1 through 6. The following "field investigation questions" were developed to guide the design of the field investigations and ensure that the effort meets the needs of Steps 2 and 3 of the DQO process, as described above.

1. What are the contaminants of potential concern (COPC) and the contaminants of potential ecological concern (COPEC) in the environmental media, based on frequency of detection and comparison to a background or reference sample population, risk-based criteria, ARARs (*e.g.*, NJDEP criteria), and/or PRGs?
2. What is the current spatial distribution of COPC and COPEC concentrations in the river sediments, both horizontally and vertically?
    a. What is the current inventory of COPCs and COPECs in the river?
    b. What fraction of this inventory is or will become available over time?
    c. What is the most upstream point potentially impacted by contaminants released in the saline (brackish) portion of the estuary?
3. What is the horizontal and vertical extent of the contaminated sediments in the Passaic River?
4. What are the major sources and processes controlling COPC and COPEC distribution in the Lower Passaic?
    a. What are the major external sources of the COPCs and COPECs to the Lower Passaic?
        i. What are the loads at the Dundee Dam?
        ii. What are the loads contributed by the tributaries?
        iii. What are the loads contributed by CSOs and sewer discharges?
        iv. What are the loads contributed by direct industrial discharges?
        v. What are the magnitude and the direction of the net tidal transport in the river?
        vi. What is the magnitude of gas exchange and dry and wet atmospheric deposition?
    b. What are the major internal processes affecting COPCs and COPECs?
        i. What are the contributions of sediment resuspension and deposition (from storms, bioturbation, tidal action, *etc.*), adsorption and desorption, porewater diffusion and porewater displacement (groundwater movement)?
        ii. What other in-river processes may be important (photolysis, hydrolysis, precipitation)?
5. How will sediment erosion and depositional mechanisms (including storm events and tidal influences) in the Passaic River affect the fate and transport of contaminated sediment, COPCs, and COPECs (*e.g.*, will burial of contaminated sediment by new sediment impact recovery/natural attenuation)?
6. How have the external and internal sources varied over time and how are they likely to vary in the future?
    a. How will external loads be expected to vary?
    b. What factors govern the internal loads and how will these vary?
7. What are the major hydrodynamic and hydrological factors that affect the distribution of the COPCs?
    a. Tidal exchange
    b. Location of salt wedge (including stratification of flow)
    c. Freshwater flow
    d. Point sources (CSO, SSO, *etc.*); distributed sources (surface runoff, atmospheric inflow, groundwater inflow)
    e. Current velocities and trends (including cross channel velocities)
    f. Internal mixing (dispersion)
8. What control structures (*e.g.*, dams, locks, tide gates) are present in the Passaic River and adjacent waterways and how do they need to be considered in hydrodynamic evaluations/modeling?

9. How important are groundwater-based sources to the overall COPC loads?
    a. What is the relevant magnitude of the groundwater loads compared to other sources?
    b. Can these loads be measured?
10. What are the current levels of exposure (exposure point concentrations) in the water, sediment and biota? How will these levels vary over time?
11. What is the vertical and horizontal extent of unacceptable COPEC concentrations in the Passaic River?
    a. What are the locations of surface and subsurface sediments with unacceptable COPEC concentrations?
12. How does the available inventory of each COPC compare with the external loads on an annual basis?
    a. What portion of the sediment-bound COPC inventory is available to support sediment-water exchange?
    b. How does the rate of sediment-bound COPC deposition vary across the study area?
13. What is the rate at which each COPC/COPEC attenuates (including biodegradation and weathering mechanisms), is exported or becomes unavailable from locations along the river?
14. What are the major processes that govern biological uptake?
    a. What are major pathways and media for biological exposure, *i.e.,* sediment, water?
    b. Do any of the COPCs require a better model than a BAF/BCF framework?
    c. Are site-specific factors needed?
15. Do current or projected future COPC concentrations in sediments and water from the Passaic River pose an unacceptable risk (defined as non-cancer risk exceeding HQ of 1 or cancer risk exceeding 10^{-6}) to human receptors?
16. Do current or projected future COPC concentrations in tissues of fish and shellfish from the Passaic River pose an unacceptable risk (defined as non-cancer risk exceeding HQ of 1 or cancer risk exceeding 10^{-6}) to human receptors?
17. Are chemical constituents in the Passaic River study area sediments and tissues of organisms living in the study areas, posing unacceptable risk to ecological receptors (benthic invertebrates, fish, piscivorous mammals, piscivorous birds)?
18. Can sediment chemistry data be used to establish exposure-response relationships and develop protective concentration levels for surface and subsurface sediments in the Passaic River?
19. Will contaminant loading to and from sources outside the Lower Passaic River (LPR) recontaminate the Passaic River following a potential sediment remediation action in the Passaic River?
20. How will the presence of debris, the volume and extent of contaminated sediment, and the physical/geotechnical and chemical properties of the contaminated sediment impact the feasibility of dredging and other remedial alternatives?
21. How will the availability of disposal sites (*e.g.*, upland sites, CDFs) and their acceptance criteria impact the feasibility of remedial dredging?
22. What is the forecasted reduction in human and ecological risk for various remedial alternatives (*e.g.*, minimization of contaminant export from a particular tributary) and over what future duration?
23. Is there a quantifiable/defensible benefit to conducting additional sediment remediation (beyond what is required under CERCLA) through a WRDA contribution to the remedial effort?
24. What significant or unique habitats and communities might be disturbed by remedial action (*e.g.*, submerged aquatic vegetation, wetlands, threatened or endangered species)?
25. What cultural resources may be disturbed by remedial action?
26. To what extent are Passaic River remedial actions warranted/feasible to reduce the export of contamination to other areas in the Hudson Raritan Estuary, even though recontamination of the Passaic River sediments may be experienced due to uncontrolled upstream sources?
27. What efforts are needed to prepare adequate site mapping for the presentation and assessment of RI data?

The Technical DQOs within Tables 1 through 6 below were designed to address the data needs for these questions, and are grouped by general categories of data needs, as listed below:

- Table 1 - Site Physical Characteristics

- Table 2 - Nature and Extent of Contamination
- Table 3 – Human Health Risk Assessment
- Table 4 – Ecological Risk Assessment
- Table 5 - Expected Performance Requirements of Treatment Alternatives
- Table 6 - WRDA Restoration Efforts

Table 1 Technical Data Quality Objectives for “Site Physical Characteristics”

STEP 1: STATE THE PROBLEM

As discussed in the “Project Level” DQOs, decision inputs necessary to address the study questions include data on the hydrodynamic and sediment transport mechanisms and physical characteristics within the Lower Passaic River Study Area and at the boundaries of adjacent waterways. The following efforts are required:

- Characterize the hydrologic, hydrodynamic and sediment transport characteristics of the Study Area to support the development of a hydrodynamic, sediment transport, and contaminant fate and transport model.
- Characterize the physical features of Study Area including upland topography, river bathymetry, stratigraphy, habitat, *etc.*

STEP 2: IDENTIFY THE DECISION

The following decision statements require resolution:

1. What are the major hydrodynamic and hydrological factors that affect the distribution of the COPCs and COPECs?
    a. Tidal exchange
    b. Location of salt wedge (including stratification of flow)
    c. Freshwater flow
    d. Point sources (CSO, SSO, *etc.*); distributed sources (surface runoff, atmospheric inflow, groundwater inflow)
    e. Current velocities and trends (including cross channel velocities)
    f. Internal mixing (dispersion)
2. What control structures (*e.g.*, dams, locks, tide gates) are present in the Passaic River and adjacent waterways and how do they need to be considered in hydrodynamic evaluations/modeling?
3. How will sediment erosion and depositional mechanisms (including storm events and tidal influences) in the Passaic River affect the fate and transport of contaminated sediment, COPCs, and COPECs (*e.g.*, will burial of contaminated sediment by new sediment impact recovery/natural attenuation)?
4. What are the geotechnical properties of sediments in the Lower Passaic River and its tributaries, adjacent waterways (*e.g.*, Hackensack River) and their tributaries, Newark Bay, and flood plain areas?
5. What is the bathymetry of the Lower Passaic River?
6. What is the utility of geophysical investigations (side scan sonar and sub-bottom profiling) in the Lower Passaic River for identification of sediment type, stratigraphy, and debris targets?
7. What are the physical features and topography of upland project areas adjacent to the Lower Passaic River, including the [*10, 20, 100*] -year flood plains?
8. What significant or unique habitats and communities might be disturbed by remedial action (*e.g.*, submerged aquatic vegetation, wetlands, threatened or endangered species)?

STEP 3: IDENTIFY INPUTS TO THE DECISION

<u>Hydrologic, Hydrodynamic and Sediment Transport Model Development</u>

1. Baseline, fixed-point, time series surface water quality data (*e.g.*, water levels, temperature, and salinity) for calibration of the hydrodynamic components of the model. Total suspended solids (TSS), particulate organic carbon (POC), and grain size measurements under varying tidal conditions, upstream river discharge, and stratification.
2. Water quality data collected from instruments installed on permanent moorings, including current velocity data from Acoustic Doppler Current Profilers, conductivity and temperature data from probes, and turbidity data from Optical Backscatter Sensors.

Table 1 Technical Data Quality Objectives for "Site Physical Characteristics"

3. Results of CTD surveys (salinity, temperature, and pressure data) supplemented by sampling for suspended sediment concentration, total dissolved salts, conductivity, particulate organic carbon (POC), grain size, TSS, and volatile suspended solids (VSS). Vertical profile data collected at NJDOT-OMR mooring sites including TSS, total dissolved salt, conductivity, and water density. Vertical profile data collected at Superfund mooring sites for TSS, VSS, and conductivity.
4. Results of detailed tidal cycle surveys conducted by NJDOT-OMR in Harrison Reach to characterize the spatial structure of currents, stratification, and bottom shear stress in the vicinity of the pilot dredging study, supplemented by water sampling for TSS, dissolved salt, conductivity, and grain size. Results of Superfund cross-sectional surveys at neap and spring tides supplemented by water sampling for TSS, VSS, conductivity, and grain size.
5. Results of characterization of surface water above the Dundee Dam for TSS, VSS, grain size of suspended solids in water samples, POC, Be-7, and Th-234. Data from flow gauges at Dundee Dam. Information on loads from CARP database. Refer also to Contaminant Mass Balance in Table 3.
6. Location and depth to sediment from bathymetric survey, results of radiological analysis of surface sediment samples for beryllium-7 and thorium-234, characterization of recent sedimentation rates and patterns using lead-210 profiles, evaluation of erosion rates using a Gust Microcosm erosion testing device, and results of water column suspended particle sample settling velocity analyses using a Modified Valeport Settling Tube. Also HydroQual Particle Entrainment Simulator (PES) data and along-river pressure gradient data from paroscientific pressure sensors mounted on moorings to provide bulk estimates of bottom shear stress.

<u>Sediment Physical Properties</u>

1. Grain size distribution (sieve and hydrometer analyses), bulk density, dry density, porosity, organic carbon content from sediments of the Passaic River and its tributaries, adjacent waterways and their tributaries, Newark Bay, and the floodplain.
2. Obtain bed properties of Passaic River and its tributaries, adjacent waterways and their tributaries, Newark Bay, and floodplain areas.
3. Soil geotechnical properties in riverbank areas.

<u>Bathymetry and Geophysical Surveys</u>

1. Bathymetric survey data and mapping in hardcopy and electronic formats, including 2004 data and digitized (not scanned) versions of historical bathymetric surveys.
2. Identification of potential deposition and scour areas.
3. Identification of potential bathymetric changes associated with historic storms (*i.e.*, Hurricane Floyd).
4. Side scan sonar (SSS) and sub-bottom survey data from a limited number of "prove-out" locations.
5. "Ground truth" sediment grab samples and cores for calibration of the SSS and sub-bottom data.
6. If SSS is implemented, the texture of surficial sediments (*i.e.*, ripple patterns, debris patterns, *etc.*).
7. If SSS is implemented, the amount/extent of debris and other targets (*e.g.*, utilities, wrecks) in the Passaic River for evaluate the feasibility of remedial dredging and the feasibility of achieving restoration objectives at a particular site.
8. If sub-bottom surveying is implemented, the sediment stratigraphy below the Study Area riverbed.

<u>Site Features and Topography</u>

1. Land surveying and aerial photography field data.
2. Topographic maps at 1 inch = 30 ft scale that meet ASPRS Class 3 Map Accuracy for investigation planning and subsequent visual presentation of RI/FS data.
3. Shoreline and planimetric electronic data in AUTOCAD and ARCGIS electronic formats.
4. Land use, vegetation types, urban characteristics, *etc.* of floodplain area adjacent to the Passaic River and its tributaries, adjacent waterways and their tributaries, and Newark Bay.

<u>Habitat Assessment and Delineation</u>

1. Delineation and assessment of submerged aquatic vegetation (SAV), wetland, and shoreline habitats.
2. Identification of threatened or endangered species or unique communities/populations.

STEP 4: DEFINE THE STUDY BOUNDARIES

The spatial boundaries of the study consist of:

- The 17-mile reach of the Lower Passaic River (the Study Area)

Table 1 Technical Data Quality Objectives for "Site Physical Characteristics"

- The boundaries of the Study Area with the tributaries, the Dundee Dam, and Newark Bay
- The [*10, 20, or 50*] -year floodplain.

The boundaries of specific RI/FS activities are described below:

<u>Hydrologic, Hydrodynamic and Sediment Transport Model Development</u>

1. Water quality monitoring mooring installations will include:
   a. Harrison Reach Deep Channel (OMR)
   b. Harrison Reach Shoaling Southern Flank (OMR)
   c. [Four other locations] (OMR)
   d. Between the Dundee Dam and Third River (Superfund)
   e. Between the Third River and the Second River (Superfund)
   f. Kearny Reach (Superfund)
   g. Newark Bay (TSI)

The temporal boundaries of the OMR mooring deployments are expected to include late summer to late fall 2004 and late winter to late spring 2005.

2. CTD survey boundaries will extend from Newark Bay to the head of salt/navigable extent of river (OMR) and from RM 12 to the Ackerman Bridge/RM 16 (Superfund). CTD casts will be at 1-km intervals for OMR and 1-mile intervals for Superfund efforts. The temporal boundaries will be approximately from June 2004 through June 2005, consisting of 12 monthly OMR survey events on dates chosen to represent a wide range of river discharges (with an emphasis on high discharge events) and approximately 10 Superfund survey events. Vertical profile data collected from moorings will be obtained at mooring deployment and retrieval.
3. Four days of shipboard surveys (two neap tide and two spring tide) in late summer/early fall 2004 in the Harrison Reach (OMR). Four days of shipboard surveys (two neap tide and two spring tide) from RM 5 to the Ackerman Bridge along river sections spaced one mile apart (Superfund).
4. [Dundee Dam Sampling Timeframe]
5. Surface sediment sampling will be conducted at the mooring locations and along the cross-section of the ETM. Special sediment studies will be carried out as a 3-day program in Spring 2005 with sample collection at 3 sites chosen in consultation with EPA, USACE, and NJDOT-OMR. The sampling sites will likely include Newark Bay, Harrison Reach, and an upstream, freshwater location.

The model will be developed to conduct a 70-year forecast of conditions in the Study Area.

STEP 5: DEVELOP A DECISION RULE

<u>Hydrologic, Hydrodynamic and Sediment Transport Model Development</u>

1. Characterize the strength of the two-layer flow in the Study Area, delineate location of salt wedge and stratification as a function of river flow, and identify processes affecting short-term particle transport and deposition, especially at the estuarine turbidity maximum.
2. Provide information on cross-channel circulation and assess the ability of the model to simulate vertical and cross-channel shear flows.
3. Quantify the baseline flux of water, sediment, and contaminants entering system (*e.g.*, flowing over the Dundee Dam) and contaminant loads (refer also to Contaminant Mass Balance in Table 3)
4. Characterize sediment deposition, transport, erosion mechanisms and rates, and evaluate sediment stability.

<u>Sediment Physical Properties</u>

1. Sediment geotechnical data (grain size) will be examined for a potential correlation with chemical data.
2. The stability of river bank slopes will be examined and the need for bank stabilization measures during remedial dredging will be evaluated.

<u>Bathymetry</u>

1. Bathymetric data will be used with sediment chemical data and remedial action goals to develop estimated contaminated sediment volumes.
2. If comparison of historic bathymetric data to 2004 data indicates significant changes in river bed elevation (≥2? feet), the usability of historic sediment analytical data will be qualified appropriately and the design of the Low Resolution Coring Program adjusted accordingly.

<u>Geophysical Surveys</u>

Table 1 Technical Data Quality Objectives for "Site Physical Characteristics"

1. If surface sediment type mapping obtained from the SSS evaluation correlates with chemical data on the extent of COPCs and COPECs, the mapping will be used as an additional line of evidence for the determination of the horizontal and vertical extent of contaminated sediment (see Table 2).
2. The amount and type of debris identified via SSS will be considered during evaluation of remedial alternatives.
3. Sub-bottom data will be used, where possible, to correlate sediment stratigraphy with the horizontal and vertical extent of contaminated sediment.
4. Sub-bottom data will be used, where possible, to identify the depth to the bedrock surface and assess the impact of various stratigraphic units that may be present on the feasibility of remedial alternatives such as dredging.

<u>Habitat Assessment/Delineation</u>

1. If unique habitats or populations are observed, their impact on remedial implementation and feasibility will be assessed.

STEP 6: EVALUATE DECISION ERRORS

Please refer to Step 6 in the "Project Level" DQO discussion.

STEP 7: OPTIMIZE THE DESIGN FOR OBTAINING DATA

The RI/FS field investigation design will be optimized by adhering to industry standards and USACE/USEPA guidance for program development, through review by the TAC and USACE/USEPA project management and technical staff, and based on experience gained from similar projects.

Table 2
Technical Data Quality Objectives for
Nature and Extent of Contamination

STEP 1: STATE THE PROBLEM

To support the development of the human health and ecological risk assessments, evaluate the need for remedial action, and facilitate the comparative evaluation of remedial alternatives, it is necessary to define the physical and chemical characteristics of contamination, the volume of contamination, and the extent of contaminant migration in the Study Area. The following efforts are required:

- identify the contaminants of potential concern (COPC) and quantitate their concentrations in the Study Area environmental media
- identify the contaminants of potential ecological concern (COPEC) and quantitate their concentrations in the Study Area environmental media
- define the spatial extent of contamination in the sediments and water column within the Study Area
- develop a mass balance (inventory) for the COPC and COPEC

STEP 2: IDENTIFY THE DECISION

The following decision statements require resolution:

1. What are the COPC and COPEC in the Study Area environmental media?
2. What is the current spatial distribution of COPC and COPEC concentrations in the river sediments, both horizontally and vertically?
    a. What is the current inventory of COPCs and COPECs in the river?
    b. What fraction of this inventory is or will become available over time?
    c. What is the most upstream point potentially impacted by contaminants released in the saline (brackish) portion of the estuary?
3. What is the horizontal and vertical extent of the contaminated sediments (unacceptable COPC and COPEC concentrations) in the Study Area?
4. What are the major sources and processes controlling COPC and COPEC distribution in the Lower Passaic?
    a. What are the major external sources of the COPCs and COPECs to the Lower Passaic?
        i. What are the loads at the Dundee Dam?
        ii. What are the loads contributed by the tributaries?
        iii. What are the loads contributed by CSOs and sewer discharges?
        iv. What are the loads contributed by direct industrial discharges?
        v. What are the magnitude and the direction of the net tidal transport in the river?
        vi. What is the magnitude of gas exchange and dry and wet atmospheric deposition?
    b. What are the major internal processes affecting COPCs and COPECs?
        i. What are the contributions of sediment resuspension and deposition (from storms, bioturbation, tidal action, *etc.*), adsorption and desorption, porewater diffusion and porewater displacement (groundwater movement)?
        ii. What other in-river processes may be important (photolysis, hydrolysis, precipitation)?
5. How have the external and internal sources varied over time and how are they likely to vary in the future?
    a. How will external loads be expected to vary?
    b. What factors govern the internal loads and how will these vary?
6. What is the rate at which each COPC/COPEC attenuates (including biodegradation and weathering mechanisms), is exported or becomes unavailable from locations along the river?

STEP 3: IDENTIFY INPUTS TO THE DECISION

<u>Identify COPC/COPEC and their Spatial Distribution</u>

1. Volatile organic, semivolatile organic/PAH, pesticide, inorganic, PCDD/PCDF, and PCB congener, concentrations in surface and subsurface sediments, as determined via RI/FS low resolution and high resolution sediment coring programs. Sampling locations should be co-located with geotechnical

Table 2
Technical Data Quality Objectives for
Nature and Extent of Contamination

samples collected to characterize sediment bed properties (refer to Table 1).

2. Volatile organic, semivolatile organic/PAH, pesticide, inorganic, PCDD/PCDF, and PCB congener surface water concentrations from RI/FS water column sampling (*e.g.*, data from moorings, time-of-travel studies, flow-averaged sampling, float surveys, and/or event sampling). The collected samples should be coordinated with other surface water quality measurements such as TSS analyses (refer to Table 1).
3. Historical sediment and water quality data.
4. Frequency of detection of each analytical parameter.
5. Background or reference population contaminant concentrations, risk-based criteria, ARARs, and/or PRGs, lists of Class A carcinogens, *etc.*

<u>Contaminated Sediment Horizontal and Vertical Extent</u>

1. Data from "Identify COPC/COPEC" above.
2. Results of screening investigations (*e.g.*, float surveys, "underway" sediment surveys, XRF sediment field screening, and immunoassay sediment analyses) that employ rapid field surveys of water and sediment quality to identify the locations of potential contaminated sediment deposits and target these areas for subsequent Low Resolution Sediment Coring. For example, float surveys involve the collection of water column samples to identify spatial variation in detected surface water contaminant concentrations as an indicator of the potential location of contaminated sediment deposits.
3. "Data gap" low resolution coring results based on immediately preceding item 2.
4. Comparison of historic and current bathymetric mapping to identify whether storm events or other mechanisms (*e.g.*, Hurricane Floyd of 1999) redistributed contaminated sediments, necessitating recharacterization of previously sampled areas.
5. Historical sediment characterization data that meet project quality standards and are deemed to be representative of current conditions.
6. A description of contaminated sediment depositional chronology from the High Resolution Sediment Coring Program.
7. Low Resolution Coring Program co-located core results for geostatistical and/or other spatial analyses.
8. Maps of sediment physical properties (*e.g.*, grain size, geologic description, stratigraphy from core descriptions and sub-bottom profiling, if applicable) where field data indicates a correlation between contamination and specific physical properties (such as fine-grained sediments).

<u>COPC/COPEC Inventory and Mass Balance</u>

1. Results from water column sampling and float survey aqueous sample analyses.
2. Results from float survey aqueous sample analyses, bioturbation sampling, porewater sampling, and hydrogeological investigations and modeling.
3. Results of atmospheric deposition investigations including wet and dry deposition, emission records, and air-water interface concentrations for estimating deposition/volatilization.
4. Completion of the preliminary mass balance calculations and sensitivity analyses.

STEP 4: DEFINE THE STUDY BOUNDARIES

The study boundaries are the 17-mile Study Area, including a focus on boundary conditions at tributaries, the Dundee Dam, Newark Bay, and point and non-point sources.

STEP 5: DEVELOP A DECISION RULE

<u>Identify COPC/COPEC and their Horizontal and Vertical Extent</u>

1. Contaminants will be identified as COPCs if they meet the criteria in Section 5.1 of the PAR.
2. Contaminants will be identified as COPECs if they meet the criteria in Section 6.1 of the PAR.

<u>Contaminated Sediment Horizontal and Vertical Extent</u>

Sediments contaminated with COPC/COPEC above the project-established remedial action goals will be delineated using geostatistical analyses and consideration of pertinent physical data (*e.g.*, sediment types, bathymetric contours).

<u>COPC/COPEC Inventory and Mass Balance</u>

The sediment contaminant inventory will be estimated and compared to the magnitudes of external

Table 2 **Technical Data Quality Objectives for** **Nature and Extent of Contamination**
contaminant loads to aid in remedial decision making (refer also to Table 5).
STEP 6: EVALUATE DECISION ERRORS Please refer to Step 6 in the "Project Level" DQO discussion.
STEP 7: OPTIMIZE THE DESIGN FOR OBTAINING DATA The RI/FS field investigation design will be optimized by adhering to industry standards and USACE/USEPA guidance for program development, through review by the TAC and USACE/USEPA project management and technical staff, and based on experience gained from similar projects.

Table 3
Technical Data Quality Objectives for
Human Health Risk Assessment

STEP 1: STATE THE PROBLEM

The Passaic River has been impacted adversely over the years by storm water runoff, waste water treatment plant discharges, industrial discharges, accidental releases, and atmospheric deposition, through which numerous hazardous chemical constituents have been released. Some of these releases have been directly to the River, such as storm water discharges or CSO point sources, or via indirect release or accidents that may have occurred in adjacent areas and entered the River through surface runoff or atmospheric pathways. A screen of available analytical data for the Passaic River against conservative human health benchmarks indicates potentially unacceptable risk from exposure to selected inorganic and organic compounds, which are listed in the Pathways Analysis Report. Of this list, the most likely primary risk drivers are dioxins/furans, PCBs, PAHs, lead, mercury, and chlorinated pesticides.

STEP 2: IDENTIFY THE DECISION

1. Do current or projected future COPC concentrations in sediments from the Passaic River pose an unacceptable risk (defined as non-cancer risk exceeding HQ of 1 or cancer risk exceeding 10^{-6}) to human receptors?
2. Do current or projected future COPC concentrations in tissues of fish and shellfish from the Passaic River pose an unacceptable risk from consumption (defined as non-cancer risk exceeding HQ of 1 or cancer risk exceeding 10^{-6}) to human receptors?
3. Do current or projected future COPC concentrations in tissues of other potential edible species (*e.g.*, waterfowl) from the Passaic River pose an unacceptable risk from consumption (defined as non-cancer risk exceeding HQ of 1 or cancer risk exceeding 10^{-6}) to human receptors?

STEP 3: IDENTIFY INPUTS TO THE DECISION

1. Identify appropriate exposure scenarios and population groups (*e.g.,* children, subsistence fish consumers);
2. COPCs of concern in sediment, water, and edible portions of fish and shellfish tissue based on risk based contaminated screening process;
3. Calculated potential carcinogenic risks and noncarcinogenic hazard quotients for direct exposures to sediment and water as well as from consumption of fish and shellfish. Risks and hazard quotients will be calculated for both current and predicted future conditions. Calculations will be based on:
   - Concentrations of COPC in surface sediments and water from the Passaic River. Concentrations may be based on: a) current analytical measurements for surface sediments; b) current analytical measurements for sediments at depth that may be exposed in the future; c) results of sediment modeling exercises.
   - Concentrations of COPC in edible fish and shellfish tissue. Concentrations may be based on: a) current analytical measurements for fish and shellfish species collected from the River; b) estimated tissue concentrations based on food web modeling using current or predicted sediment concentrations.

STEP 4: DEFINE THE STUDY BOUNDARIES

The human health evaluation will focus on 17 miles of the Passaic River from the confluence with Newark Bay upstream to the Dundee Dam. Sediments, water and biota evaluated will be collected from this area. For the purpose of evaluating exposures to sediments, the assessment will focus on the river and adjacent mudflats or river bank areas.

STEP 5: DEVELOP A DECISION RULE

General Decision Rule: If estimated cumulative human health exposures results in an unacceptable risk (*i.e.,* cancer risk $>1 \times 10^{-6}$; non-cancer risk HI>1) further evaluations of remedial options or restoration will be considered.

STEP 6: EVALUATE DECISION ERRORS

If risks associated with site-related exposures are overestimated (*i.e.*, false positive), a potential

Table 3 **Technical Data Quality Objectives for** **Human Health Risk Assessment**
consequence is unnecessary remedial work that could itself be biologically detrimental. If risks are underestimated (*i.e.*, false negative), a possible consequence is to fail to conclude that remedial action is required, resulting in continuing potential for adverse effects to human health. To control these possible errors, exposure parameters will be carefully selected to represent realistically conservative scenarios.
STEP 7: OPTIMIZE THE DESIGN FOR OBTAINING DATA The sampling design will be described in the Sampling and Analysis Plan

Table 4
Technical Data Quality Objectives for Ecological Risk Assessment

STEP 1: STATE THE PROBLEM

The Passaic River has been impacted adversely over the years by storm water runoff, waste water treatment plant discharges, industrial discharges, accidental releases, and atmospheric deposition, through which numerous hazardous chemical constituents have been released. Some of these releases have been directly to the River, such as storm water discharges or CSO point sources, or via indirect release or accidents that may have occurred in adjacent areas and entered the River through surface runoff or atmospheric pathways. A screen of available analytical data for the Passaic River against conservative ecological and human health benchmarks indicates potentially unacceptable risk from exposure to selected inorganic and organic compounds, which are listed in the Pathways Analysis Report. Of this list, the most likely primary risk drivers are dioxins/furans, PCBs, PAHs, lead, mercury, and chlorinated pesticides.

The overall objective of the ecological risk assessment is to assess the current and future risks to ecological receptors from exposures to contaminants in the sediment and food sources (*i.e.*, prey tissue) associated with the Passaic River.

STEP 2: IDENTIFY THE DECISION

1. Do current or projected future COPC concentrations in sediments from the Passaic River pose an unacceptable risk (defined as exceeding HQ of 1) to ecological receptors of concern directly exposed to contaminants in sediment?
2. Do current or projected future COPC concentrations in sediments from the Passaic River pose an unacceptable risk (defined as exceeding HQ of 1) to ecological receptors of concern exposed to contaminants in sediment through the food web?

STEP 3: IDENTIFY INPUTS TO THE DECISION

1. Ecological Conceptual Site Model for the Passaic River to identify exposure pathways;
2. Receptors of concern determined based on exposure to sediment, consumption of contaminated prey items, habitat, and uses of the river;
3. Identification of COPEC; determined by comparisons of sediment concentrations to COPEC screening benchmarks;
4. Concentrations of COPEC in surface sediments from the Passaic River. Concentrations may be based on: a) current analytical measurements for surface sediments; b) current analytical measurements for sediments at depth that may be exposed in the future; c) results of sediment modeling exercises;
5. Concentrations of COPEC in prey items consumed by upper trophic level receptors of concern. Concentrations may be based on: a) current analytical measurements of fish and prey species collected from the River; b) estimated tissue concentrations based on food web modeling using current or predicted sediment concentrations;
6. Literature search results for chemical toxicity data for chemicals lacking sufficient toxicity information to conduct risk characterization;
7. Determine appropriate exposure factors for each receptor of concern; and,
8. Determine exposure concentrations for each COPEC.

STEP 4: DEFINE THE STUDY BOUNDARIES

The ecological risk assessment will focus on 17 miles of the Passaic River from the confluence with Newark Bay upstream to the Dundee Dam. Sediments and biota evaluated will be from this area. Receptors of concern will include aquatic organisms that reside in the Passaic River as well as higher trophic level organisms (*i.e.*, piscivorous birds) that forage in the river. For the purpose of evaluating exposures to sediments, the assessment will focus on the river and adjacent mudflats or river bank areas.

STEP 5: DEVELOP A DECISION RULE

Table 4
Technical Data Quality Objectives for
Ecological Risk Assessment

General Decision Rule: If estimated ecological exposures results in an unacceptable risk (*i.e.*, HI>1) further evaluations of remedial options or restoration will be considered.

For each line if evidence in the ecological risk assessment, determinations of risk and magnitude (*e.g.,* high or low magnitude) of risk will be provided in the Risk Assessment Work Plan.

STEP 6: EVALUATE DECISION ERRORS

If risks associated with site-related exposures are overestimated (*i.e.*, false positive), a potential consequence is unnecessary remedial work that could itself be biologically detrimental. If risks are underestimated (*i.e.*, false negative), a possible consequence is to fail to conclude that remedial action is required, resulting in continuing potential for adverse effects to human health. To control these possible errors, exposure parameters will be carefully selected to represent realistically conservative scenarios.

STEP 7: OPTIMIZE THE DESIGN FOR OBTAINING DATA

The sampling design will be described in the Sampling and Analysis Plan.

Table 5
Technical Data Quality Objectives for Evaluation of Remedial Alternatives

STEP 1: STATE THE PROBLEM

The overall problem is to comparatively evaluate remedial alternatives such as no action, monitored natural recovery, removal (with and without ex-situ treatment), in-situ treatment, capping, *etc.* via the nine CERCLA evaluation criteria.

STEP 2: IDENTIFY THE DECISION

1. How will the presence of debris, the volume and extent of contaminated sediment, and the physical/geotechnical and chemical properties of the contaminated sediment impact the feasibility of dredging and other remedial alternatives?
2. What is the forecasted reduction in human and ecological risk for various remedial alternatives (*e.g.*, minimization of contaminant export from a particular tributary) and over what future duration?
3. How will the availability of disposal sites (*e.g.*, upland sites, CDFs) and their acceptance criteria impact the feasibility of remedial dredging?
4. Will contaminant loading to and from sources outside the Lower Passaic River (LPR) recontaminate the Passaic River following a potential sediment remediation action in the Passaic River?
5. What are the RCRA disposal characteristics of contaminated sediments from the Passaic River?
6. What is the optimal remedial alternative?

STEP 3: IDENTIFY INPUTS TO THE DECISION

Remedial Alternative Screening

1. Contaminant concentrations from investigation of physical and chemical characteristics of the sources of contamination and horizontal and vertical extent of contamination from investigation of volume of contamination and extent of migration.
2. Mass balance data and characterization of external contaminant loads to the Study Area.
3. Dredge performance and monitoring data from the WRDA Dredging Pilot Study, data obtained from literature searches, and a review of geotechnical and geophysical data (*e.g.*, identification of debris from side scan sonar survey) to be obtained during investigation of site physical characteristics.
4. Treatability data from the WRDA Sediment Decontamination and In-situ/Deep Soil Mixing Pilot Studies, data obtained from literature searches, and a review of geotechnical data to be obtained during investigation of site physical characteristics.
5. Performance criteria for other in-situ/ex-situ treatment alternatives proposed to reduce the toxicity, volume, or mobility of sediment contaminants.
6. Material handling and physical properties of contaminated sediments from the Passaic River in regard to sediment dewatering and treatment issues from geotechnical testing.
7. Human and ecological risk assessments for potential remedial scenarios.

Disposal Issues

1. TCLP extract concentrations from sediment samples.
2. Geotechnical and wet chemical analyses including moisture content, TOC, and paint filter test analyses.
3. Survey of available and potential future dredged sediment disposal sites.

STEP 4: DEFINE THE STUDY BOUNDARIES

The study boundaries for the evaluation of remedial alternatives will be defined by the location and extent of contaminated sediment deposits selected for remediation, based on the horizontal and vertical extent of chemical contamination and the selected action levels for the COPC and COPEC.

STEP 5: DEVELOP A DECISION RULE

Applicable remedial alternatives (including the no action alternative) will be comparatively evaluated according to the CERCLA evaluation criteria and assigned weightings. The remedial alternative with the most favorable combined weighting will be recommended for implementation.

STEP 6: EVALUATE DECISION ERRORS

Please refer to Step 6 in the "Project Level" DQO discussion.

Table 5 Technical Data Quality Objectives for Evaluation of Remedial Alternatives
STEP 7: OPTIMIZE THE DESIGN FOR OBTAINING DATA The RI/FS field investigation design and remedial alternative comparative evaluation data gathering effort will be optimized by adhering to industry standards and USACE/USEPA guidance for program development, through review by the TAC and USACE/USEPA project management and technical staff, and based on experience gained from similar projects.

Table 6
Technical Data Quality Objectives for
WRDA Restoration Efforts

STEP 1: STATE THE PROBLEM

The following problems are to be addressed:

- Assess the suitability of candidate sites for WRDA restoration efforts. The candidate site screening effort will focus in large part on the potential presence of environmental contamination on the candidate sites. The objective is to identify sites for restoration that do not contain unacceptable levels of contamination and therefore would not pose an unacceptable risk to receptors that would be attracted to restored habitat.
- Gather data on candidate restoration sites to support development of a restoration project concept design and analysis via habitat evaluation procedures, hydrogeomorphic approach, or rapid bioassessment protocols.
- Fulfill WRDA socioeconomic and real estate data needs and NEPA-EIS data needs.
- Evaluate the extent to which additional WRDA contributions to the Lower Passaic River CERCLA remediation effort may yield desirable ecological benefits.

STEP 2: IDENTIFY THE DECISION

The following decision statements are to be resolved:

1. Do the detected concentrations of chemical contaminants in the candidate restoration site environmental media exceed NJDEP Technical Site Remediation Standards, reference values, and/or other ARARs? Are the detected concentrations of contaminants likely to have an adverse impact on site restoration (*e.g.*, plantings, biota)?
2. What is the appropriate restoration design for suitable candidate sites (*e.g.*, horticultural design and planting, aesthetics, channel layout, *etc.*) based on site-specific findings?
3. Is there a quantifiable/defensible benefit to conducting additional sediment remediation (beyond what is required under CERCLA) through a WRDA contribution to the remedial effort?
4. To what extent are Passaic River remedial actions warranted/feasible to reduce the export of contamination to other areas in the Hudson Raritan Estuary, even though recontamination of the Passaic River sediments may be experienced due to uncontrolled upstream sources?

STEP 3: IDENTIFY INPUTS TO THE DECISION

Environmental Investigations

1. TCL/TAL (PAHs only for semivolatile fraction), cyanide, PCB congener, and PCDD/PCDF concentrations in surface and subsurface soils and sediments.
2. TCL/TAL (PAHs only for semivolatile fraction), cyanide, PCB congener, PCDD/PCDF, and TOC concentrations in groundwater and surface water.
3. NJDEP Site Remediation Criteria, reference values, and ARARs for evaluation of environmental media analytical results.
4. Candidate Site Restoration chemical screening criteria, consisting of ecological risk-based action levels for adverse impacts on biota and plantings associated with proposed restoration plan.

Restoration Concept Design

1. Elevations and topographic features of the candidate restoration sites from land surveying and aerial photography field activities.
2. Geotechnical properties of candidate site soils/sediments to support restoration feasibility analyses.
3. Grades of the side slopes of the Passaic River and/or its tributaries at candidate restoration sites (for possible design of bank stabilization/regrading measures associated with restoration).
4. Site access characteristics and the locations of utilities and other features.
5. Topographic maps at 1 inch = 30 ft scale that meet ASPRS Class 3 Map Accuracy.
6. Shoreline and planimetric electronic data in AUTOCAD and ARCGIS electronic formats.
7. Characterization of groundwater and surface water elevations, fluctuations, and flow directions/regimes to understand the hydrologic factors that may affect restoration feasibility analyses.
8. Assessment of cultural resources present at candidate restoration sites that could be disturbed by

Table 6
Technical Data Quality Objectives for WRDA Restoration Efforts

rehabilitation efforts.

9. Characterize the socioeconomic characteristics of the Passaic River watershed area to support WRDA candidate restoration site decision making.
10. Evaluate the real estate characteristics of the Passaic River watershed area to support WRDA candidate restoration site decision making.
11. [Other NEPA-EIS data needs.]

CERCLA Remediation Issues

1. The results of the comparative evaluation of remedial alternatives.
2. Ecological risk assessments for potential WRDA expanded remediation scenarios.

STEP 4: DEFINE THE STUDY BOUNDARIES

The spatial boundaries of the study consist of the boundaries of the candidate restoration sites proposed for evaluation (not yet fully defined) and the CERCLA RI/FS Study Area. The temporal boundaries of the study will consist of the duration of the proposed field investigations and the RI/FS temporal boundaries.

STEP 5: DEVELOP A DECISION RULE

Candidate Restoration Sites

If a candidate restoration site does not contain unacceptable levels of contamination (numerical screening criteria to be developed on an ecological health basis), the site will be considered for WRDA restoration efforts.

Restoration Concept Design

Evaluation of the collected field investigation data and supporting analyses will be used to:

- Define the channel layout and other design parameters required for the successful establishment of a salt or brackish wetland.
- Simulate the hydraulics and the water quality characteristics of the proposed wetland system.
- Determine that suitable surface or subsurface hydrology exists to sustain the intended restoration design and foundation.
- Provide the basis for the horticultural design and planting of the wetland.
- Provide the basis for maintaining aesthetics at a site.
- Study the flooding potential in offsite areas adjacent to the restoration area.

CERCLA Remediation Issues

Cost-benefit analyses will be conducted in accordance with WRDA requirements to evaluate the feasibility of WRDA-funded contributions to sediment remediation associated with the Lower Passaic River Superfund Site.

STEP 6: EVALUATE DECISION ERRORS

Please refer to Step 6 in the “Project Level” DQO discussion.

STEP 7: OPTIMIZE THE DESIGN FOR OBTAINING DATA

The RI/FS field investigation design and remedial alternative comparative evaluation data gathering effort will be optimized by adhering to industry standards and USACE/USEPA guidance for program development, through review by the TAC and USACE/USEPA project management and technical staff, and based on experience gained from similar projects.